Comparative Packaging Study

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PURPOSE

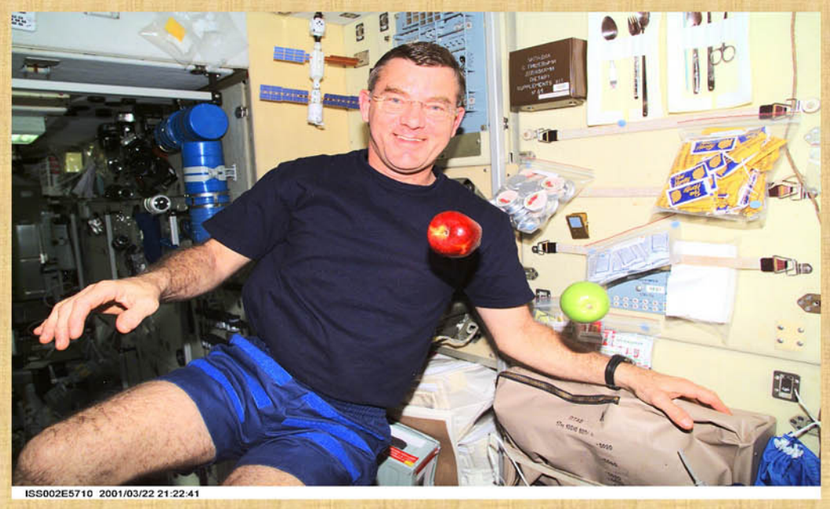
- Evaluate new high barrier food packaging films for use on long duration space missions.
- Determine the effects of:
  - High temperatures during heat sealing
  - Stress cracking from folds in the films caused by vacuum packing
  - Relative humidity during storage

Deliverables

- Quantitatively evaluate each packaging material after final processing for oxygen and water vapor transmission through analysis of ingredients susceptible to moisture uptake and lipid oxidation.
- Qualitatively determine changes in food product attributes through sensory evaluation methods after storage in 3 different packaging films.
- Evaluate the potential of each packaging material based on qualitative and quantitative results.

Food Sample Selection

- Dry cereal is prone to reduced quality from absorption of water vapor.
- Cottonseed oil is susceptible to lipid oxidation in the presence of oxygen.
- Peanuts produce a rancidity marker, hexanal, which can be quantified by analysis of the gas in the headspace of the package.



Experimental Design Matrix

MATERIALS	Cottonseed Oil	Cheerios	Peanuts
Combitherm	Cottonseed Oil/Combitherm	Cheerios/ Combitherm	Peanuts/ Combitherm
Technipaq	Cottonseed Oil/Technipaq	Cheerios/ Technipaq	Peanuts/ Technipaq
Tolas	Cottonseed Oil/Tolas	Cheerios/ Tolas	Peanuts/ Tolas

VARIABLES

Storage:	Storage:	Storage:
3 variables- *72oF & 25%RH *72oF & 50%RH *72oF & 75%RH	3 variables- *72oF & 25%RH *72oF & 50%RH *72oF & 75%RH	3 variables- *72oF & 25%RH *72oF & 50%RH *72oF & 75%RH
Analyses: *Free Fatty Acid *Peroxide Value	Analyses: *Moisture *Sensory	Analyses: *Hexanal *Sensory

Rate of Analysis = Full testing once every 3 months for 18 months, then quantitative analyses only through 36 months.

Permeation Rate Comparison

- The table below shows the oxygen transmission rate (OTR) and water vapor transmission rate (WVTR) for each packaging material listed.
- Glass and aluminum have the best available barrier properties for food packaging purposes.
- Temperature and relative humidity may have an effect on the permeation rate of a packaging film.

MATERIAL	OTR @ 73°F & 100% RH (grams/100in²/day)	WVTR @ 100°F & 100% RH (grams/100in²/day
Combitherm	5.405	0.352
Technipaq	<0.0003	<0.0003
Tolas	0.0013	0.0046
Glass	<0.0003	<0.0003
Aluminum	<0.0003	<0.0003

Cheerios

• Tolas (AlOX Coated Film)	• Technipaq Film
• Peanuts in Combitherm	• Oil in Combitherm

Packaging Material Information

Combitherm Film

- Structure: Polyamide/Ethylene Vinyl Alcohol/Polyamide/Polyethylene
- PROS: Lightweight and transparent. Microwaveable and can be incinerated.
- CONS: Requires an overwrap film due to poor barrier properties. Overwrap causes a major increase in mass for food system.

Technipaq Film

- Structure: A quadlaminate film. PET/Biax Polypropylene/Aluminum/Low Density Polyethylene with EVA
- PROS: Best barrier properties available in a film.
- CONS: Film cannot be incinerated or microwaved due to aluminum layer. Film is not clear to allow for food identification.

Tolas Film

- Structure: Two layers of PET film coated with a thin layer of aluminum oxide and LLDPE as the sealing layer.
- PROS: Very lightweight with excellent barrier properties. Transparent film. Microwaveable and can be incinerated.
- CONS: Stress cracking caused by wrinkles during vacuum packing may reduce the barrier properties.